

A photograph of an Arctic landscape. In the foreground, there are large, white icebergs floating in a body of water. In the background, there are snow-covered mountains under a pale sky. The overall scene is cold and desolate.

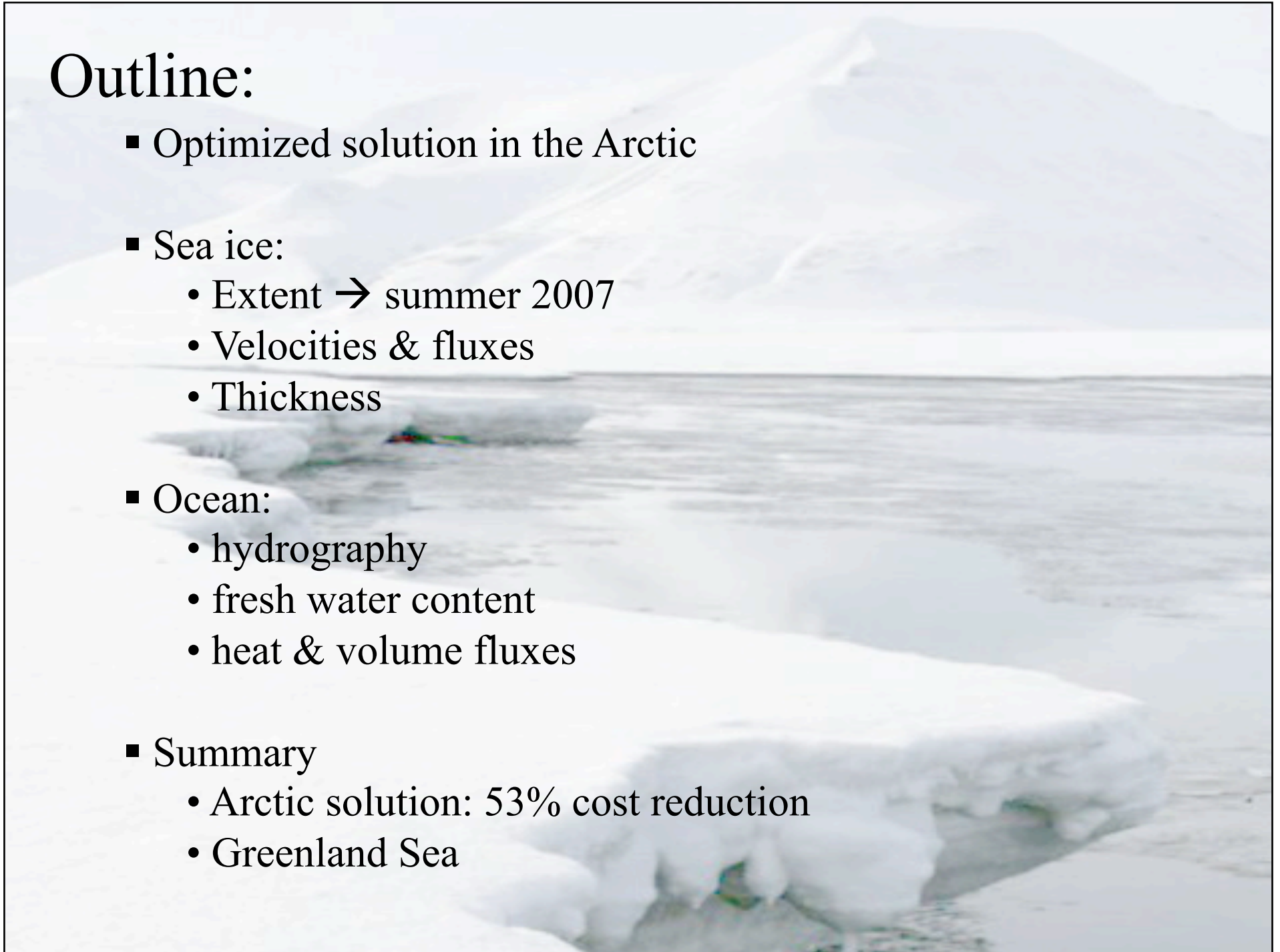
Assessment of the ECCO2 optimized solution in the Arctic

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ECCO-2 Team Meeting, MIT Sep 23-24, 2008

Outline:

- Optimized solution in the Arctic
- Sea ice:
 - Extent → summer 2007
 - Velocities & fluxes
 - Thickness
- Ocean:
 - hydrography
 - fresh water content
 - heat & volume fluxes
- Summary
 - Arctic solution: 53% cost reduction
 - Greenland Sea



Regional optimized solution:

■ Data:

- Sea-ice velocity, sea-ice thickness, CTD profiles,
- Initial conditions, Forcings

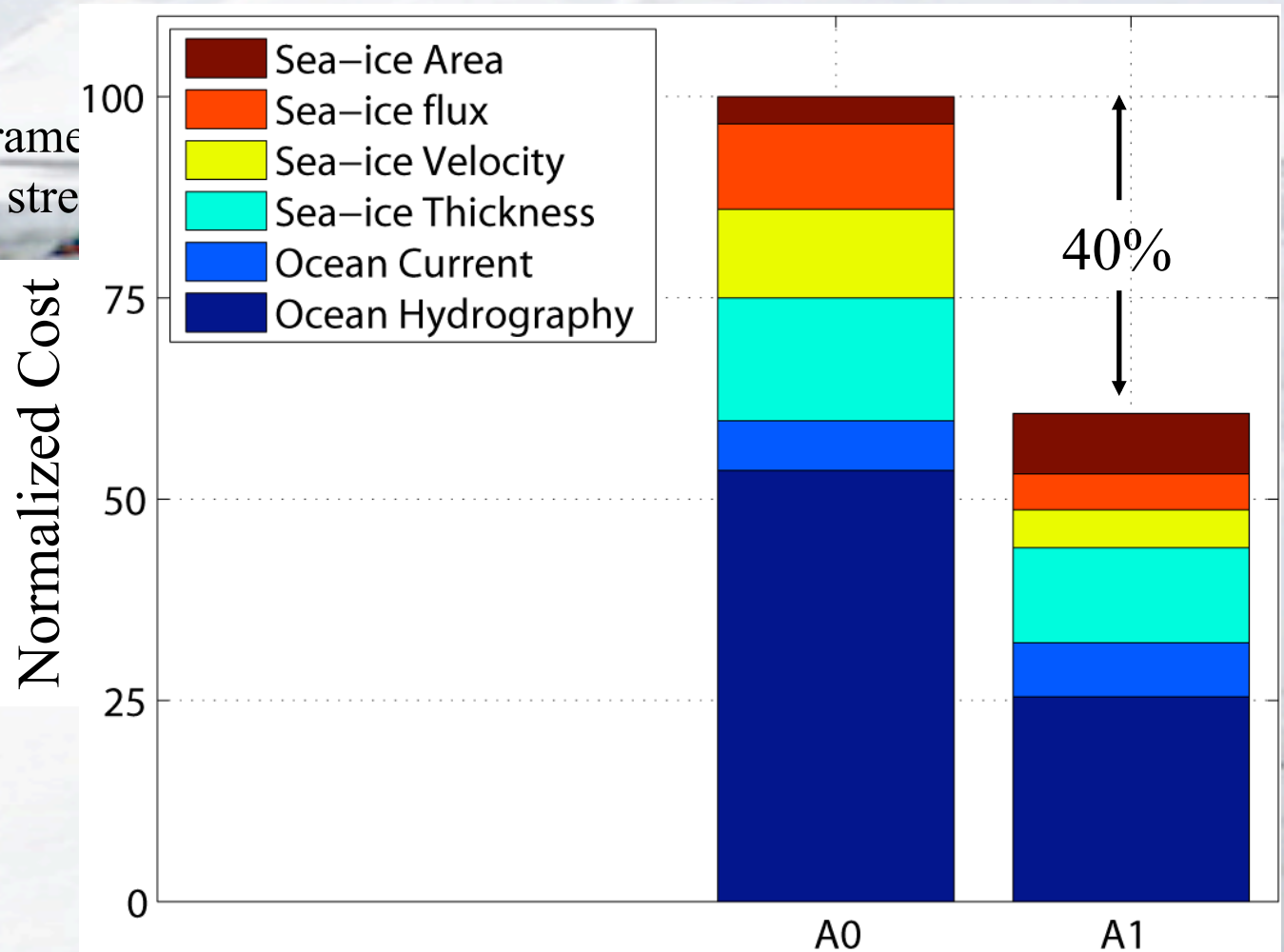
■ Parameters:

- Salt-plume parameters, albedos, sea-ice strength, Gmredi

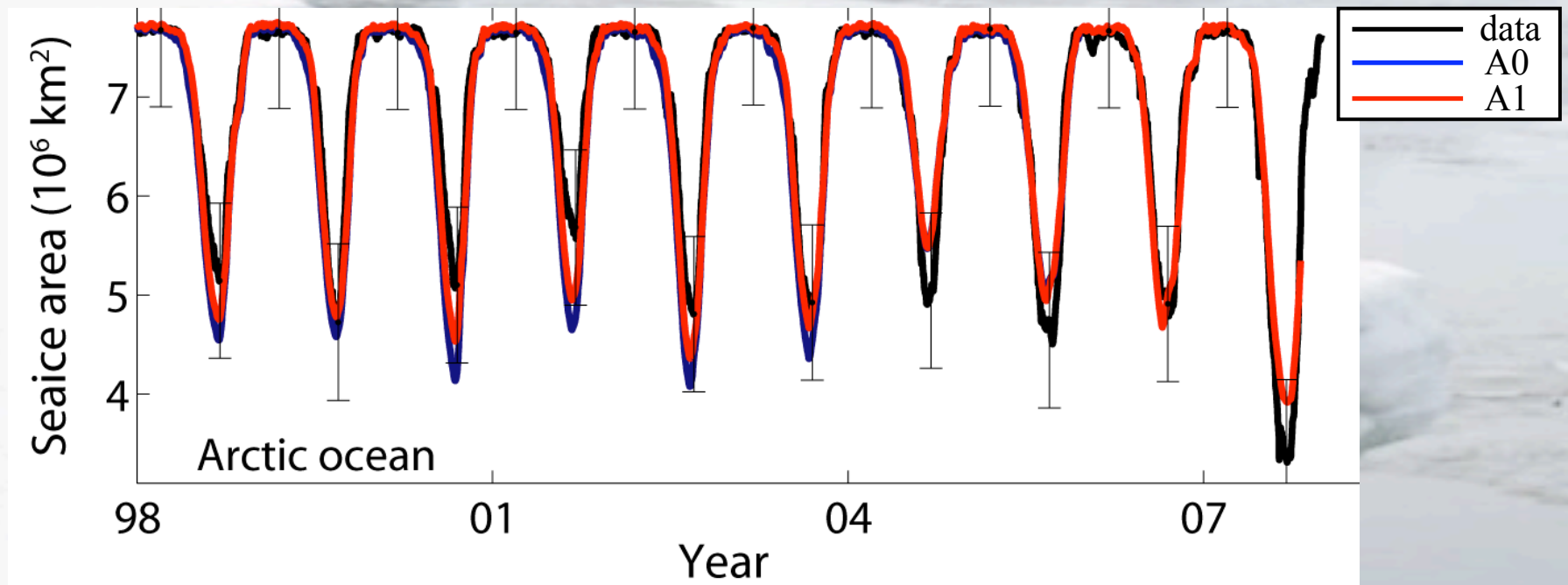
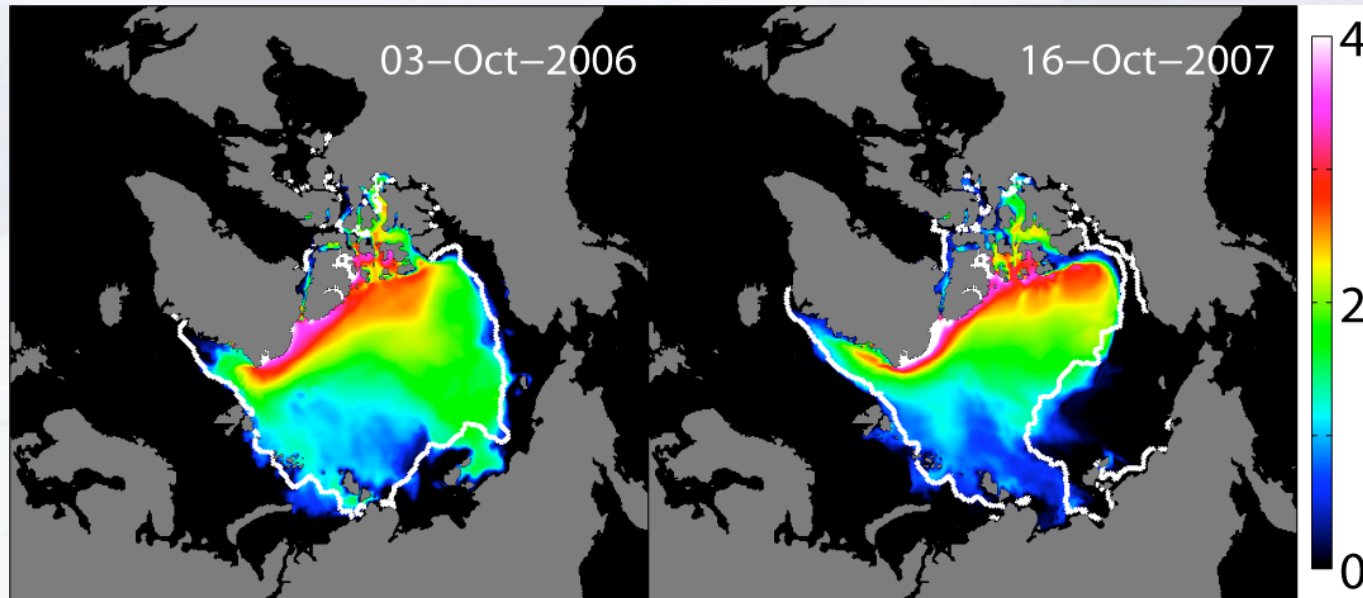
■ Solutions:

Baseline: A0

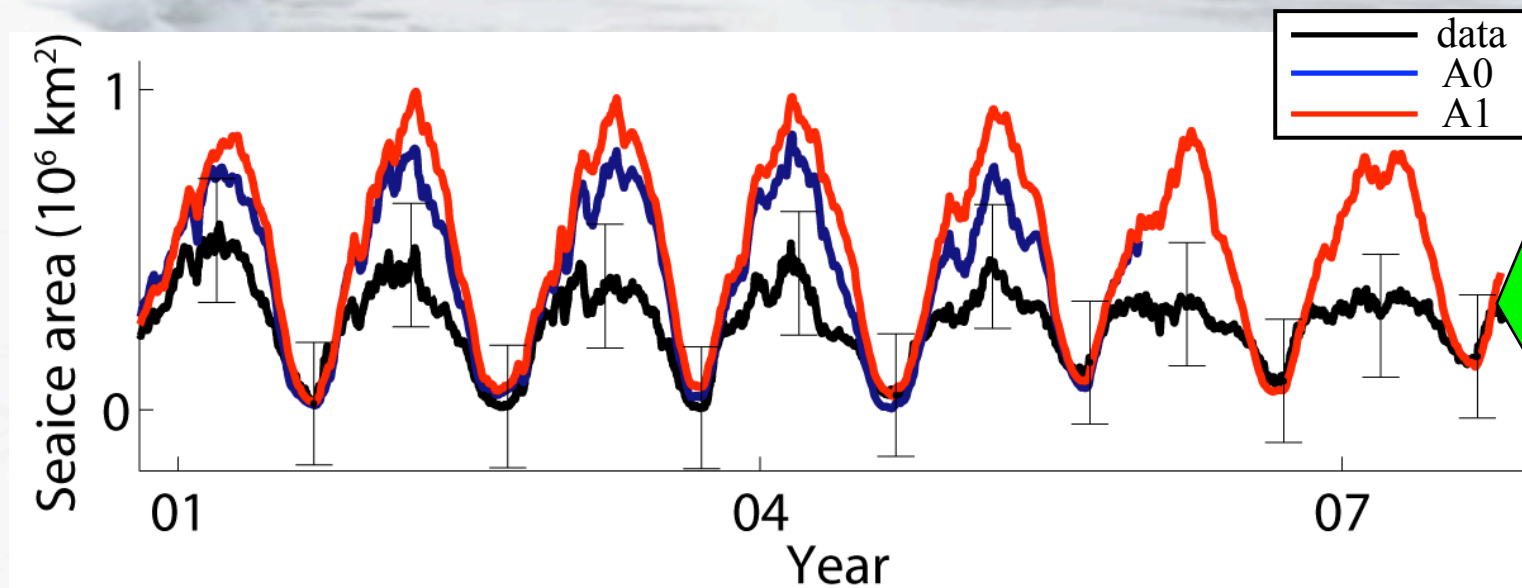
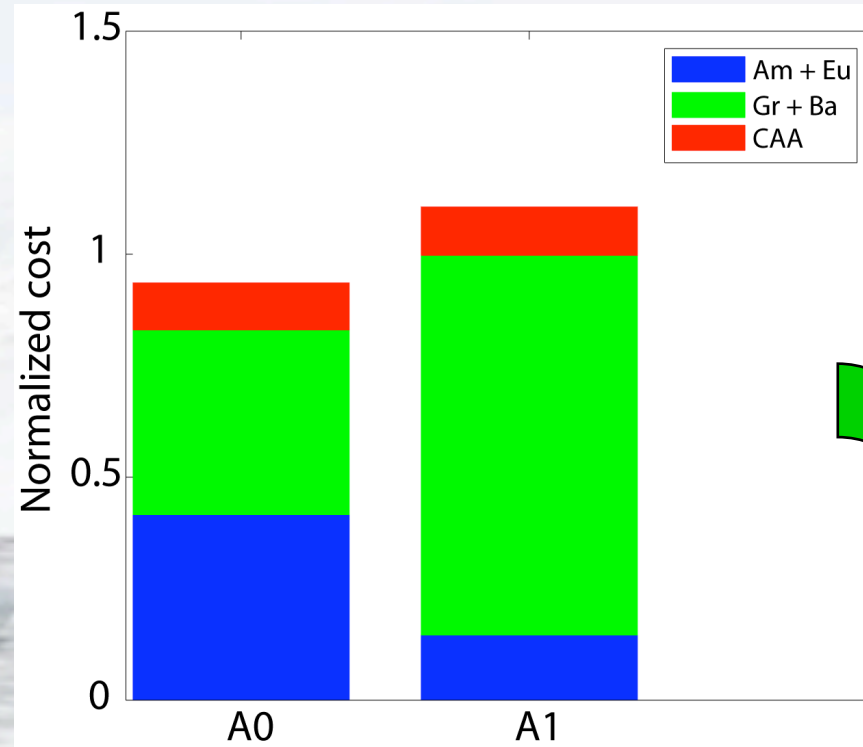
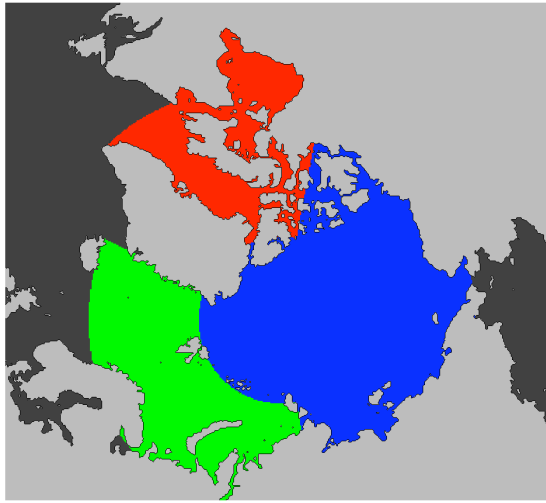
Optimized: A1



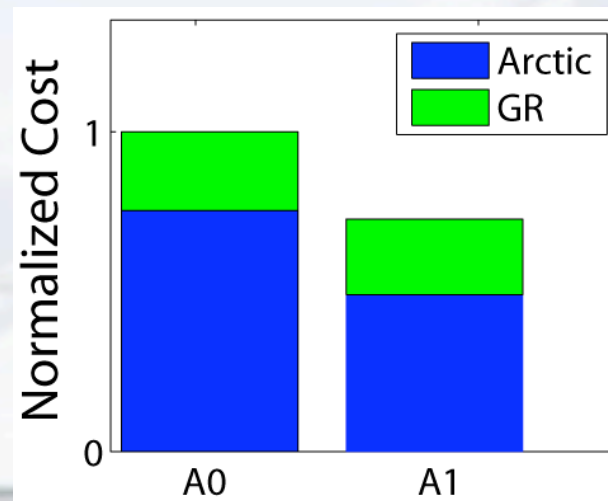
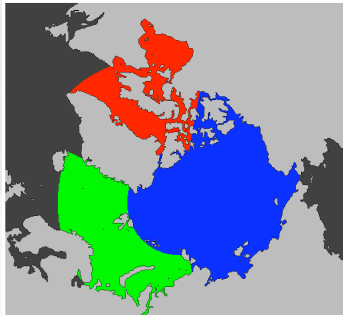
Sea ice extent



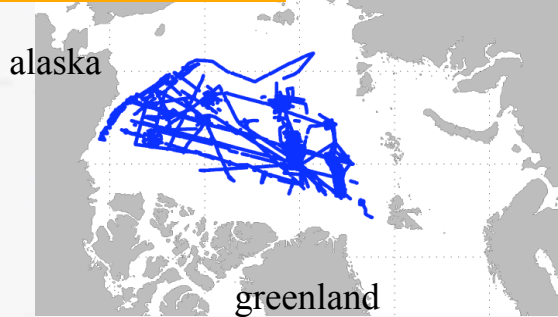
Sea ice extent



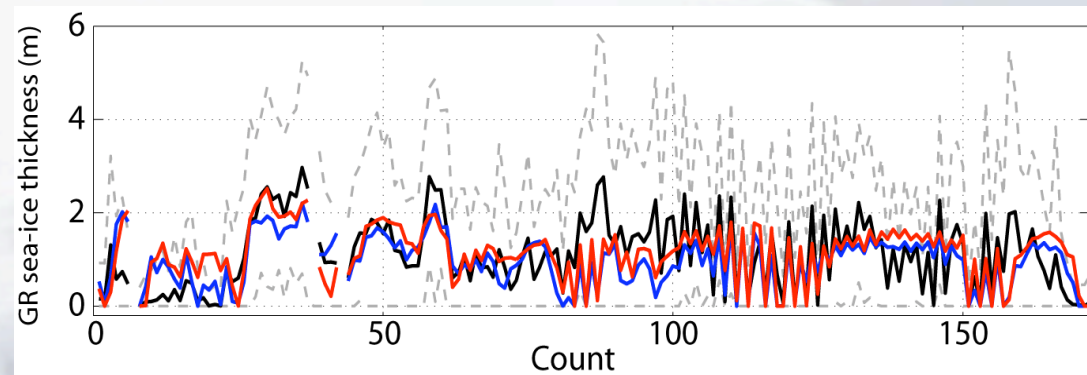
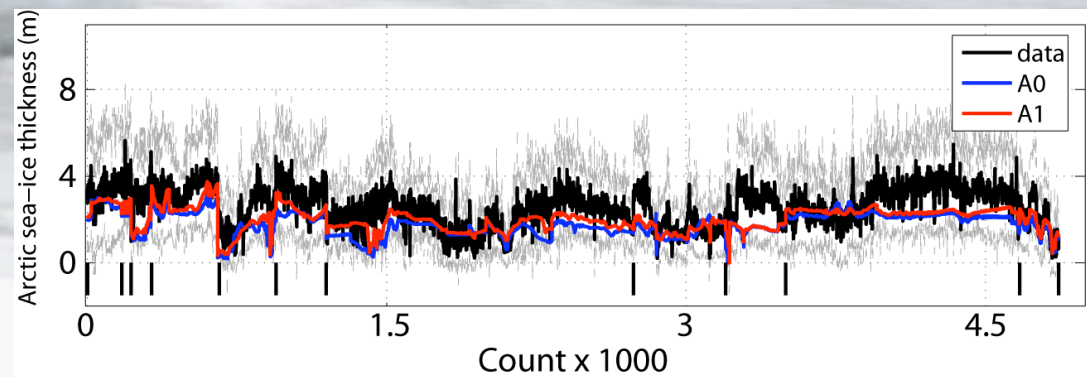
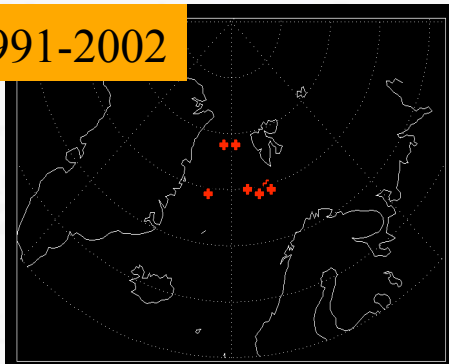
Sea ice thickness



ULS: 1991-2002 siberia



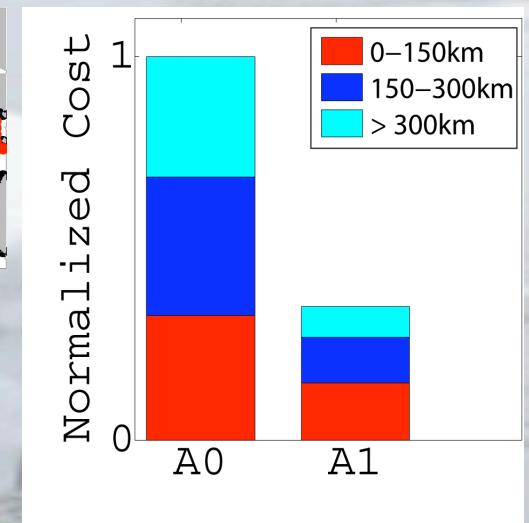
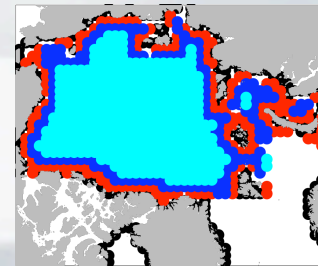
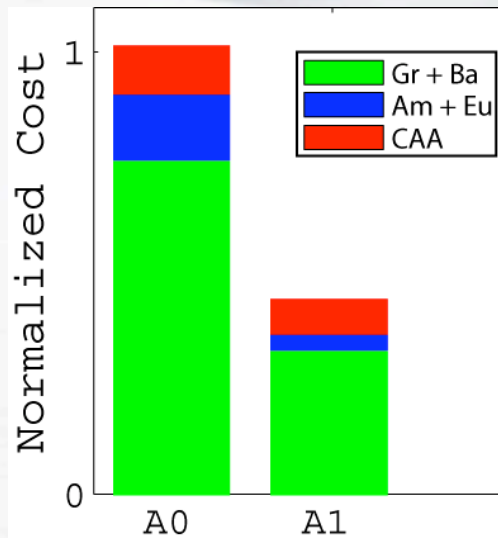
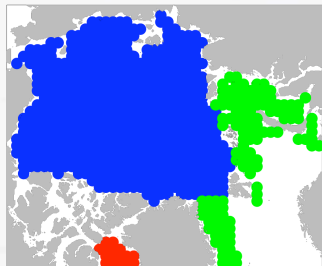
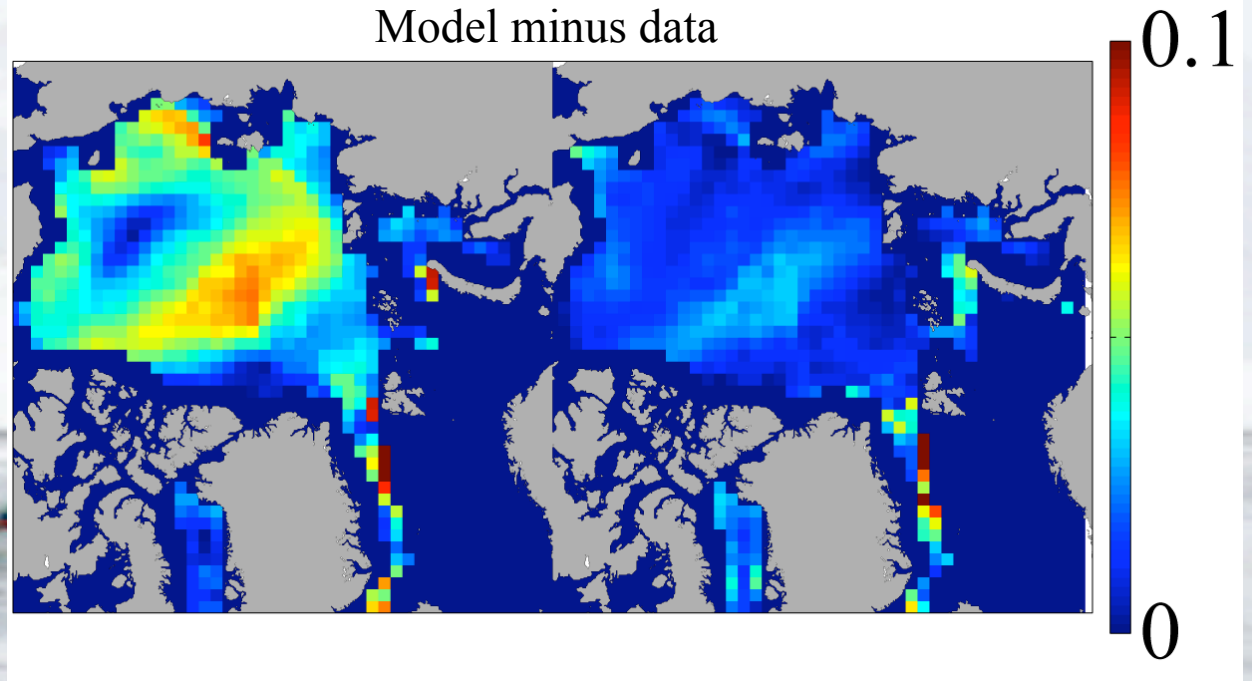
ULS: 1991-2002



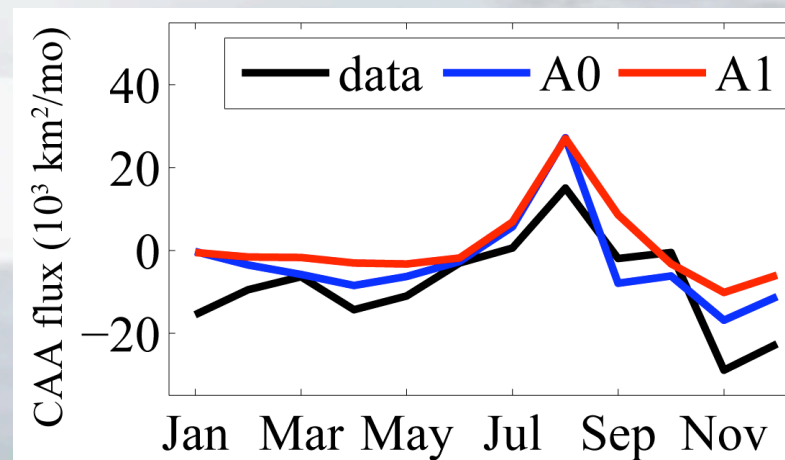
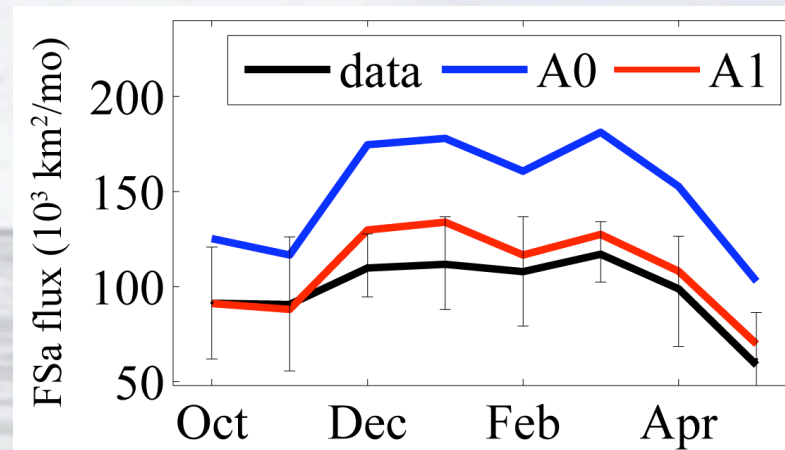
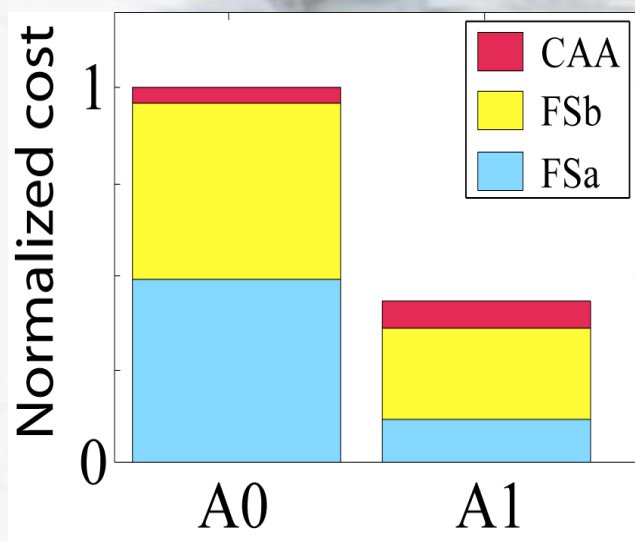
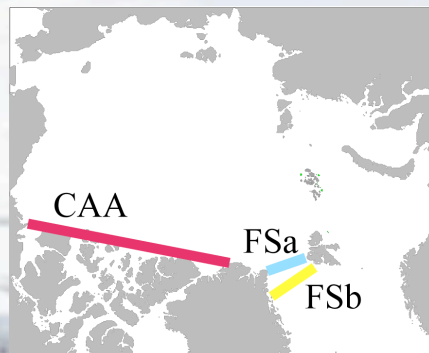
Sea ice velocity

Passive microwave derived
1992-2002

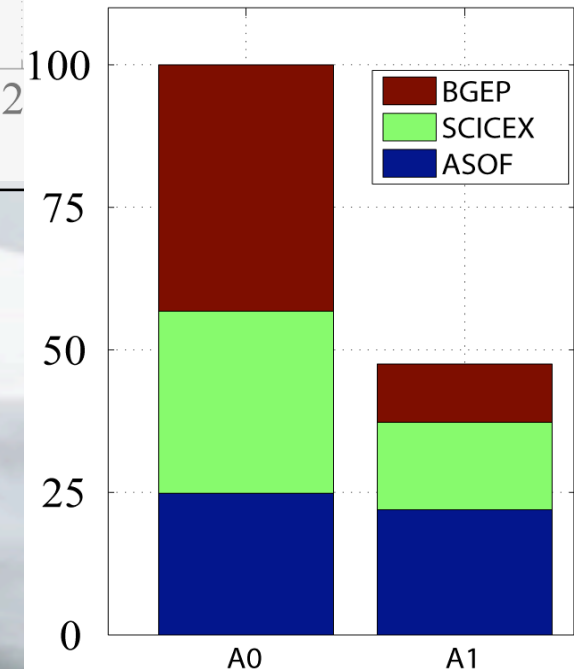
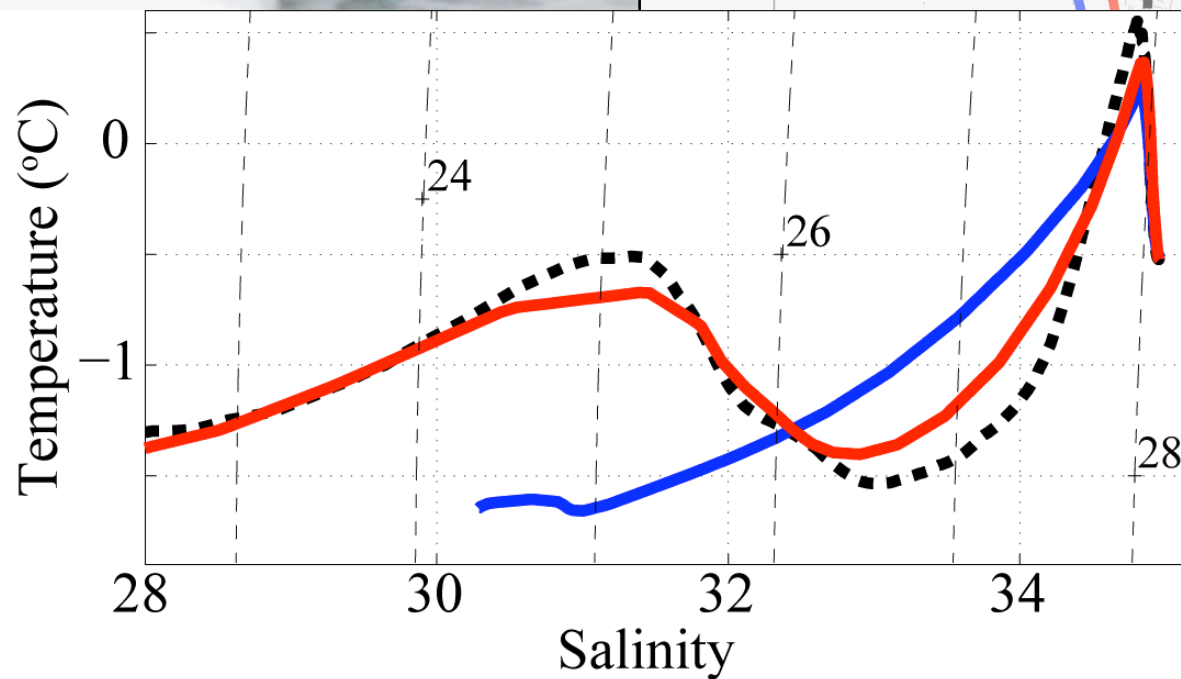
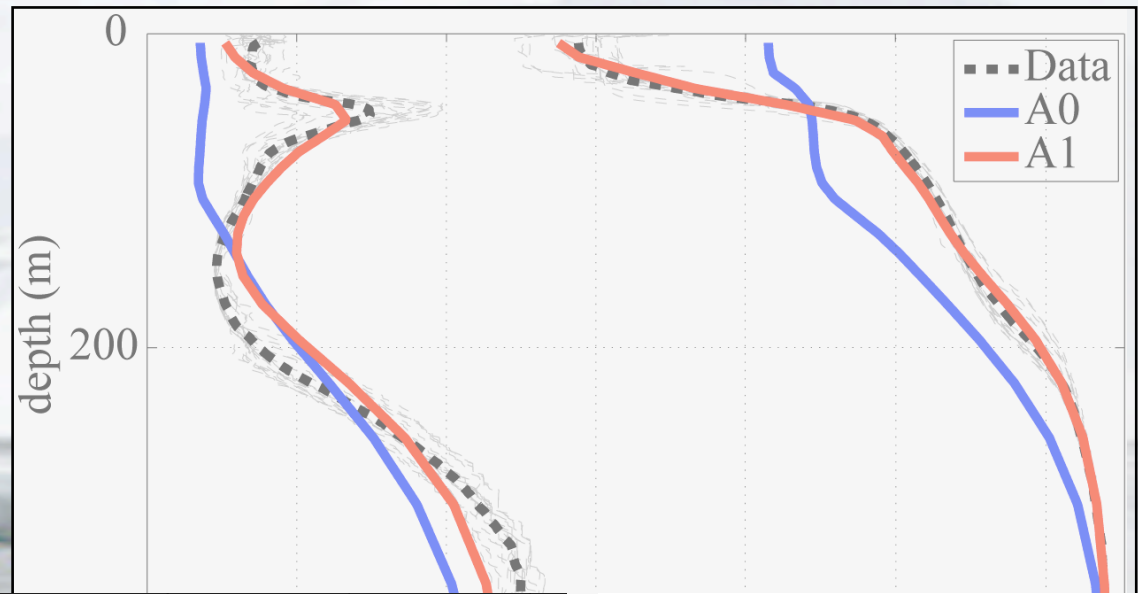
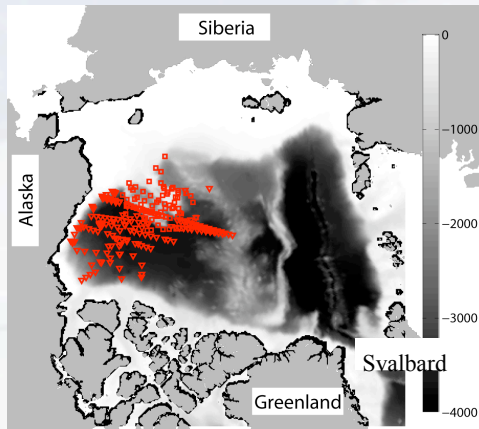
Model minus data



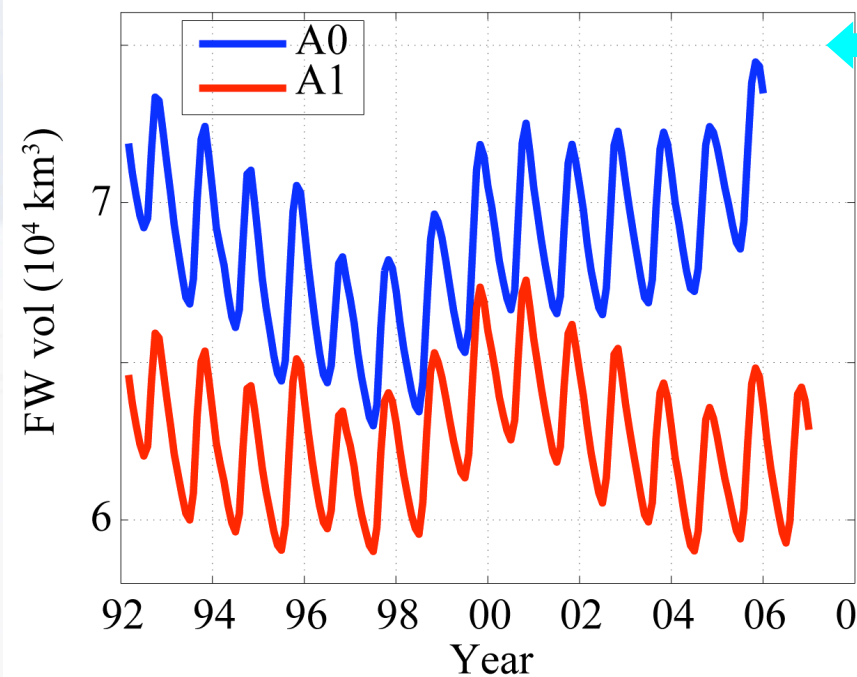
Sea Ice flux: Passive Microwave data: 1991-2002



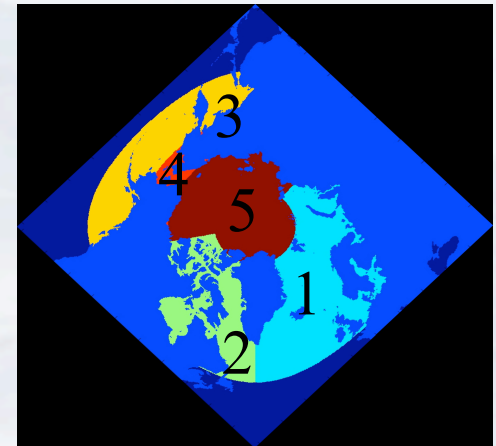
Arctic ocean hydrography



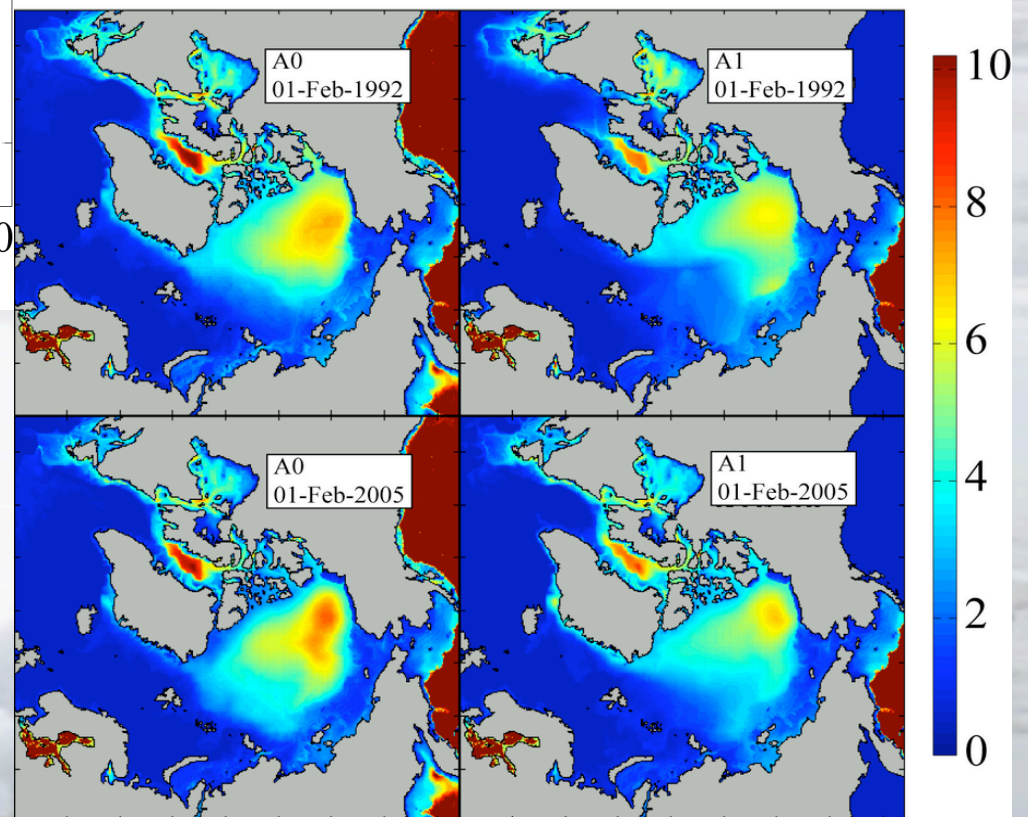
Arctic ocean (5): Fresh water volume:



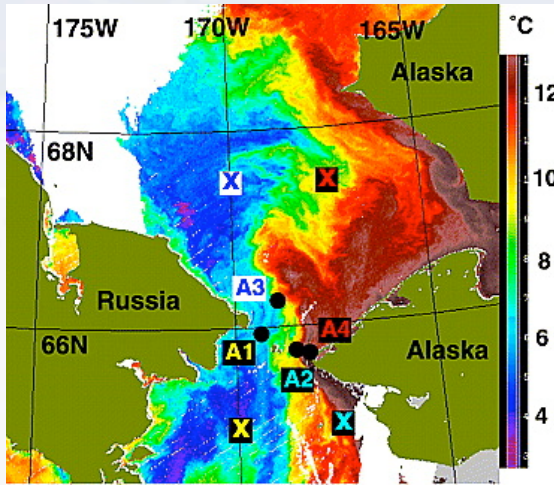
Expect:
 $\sim 7.5 \times 10^4 \text{ km}^3$



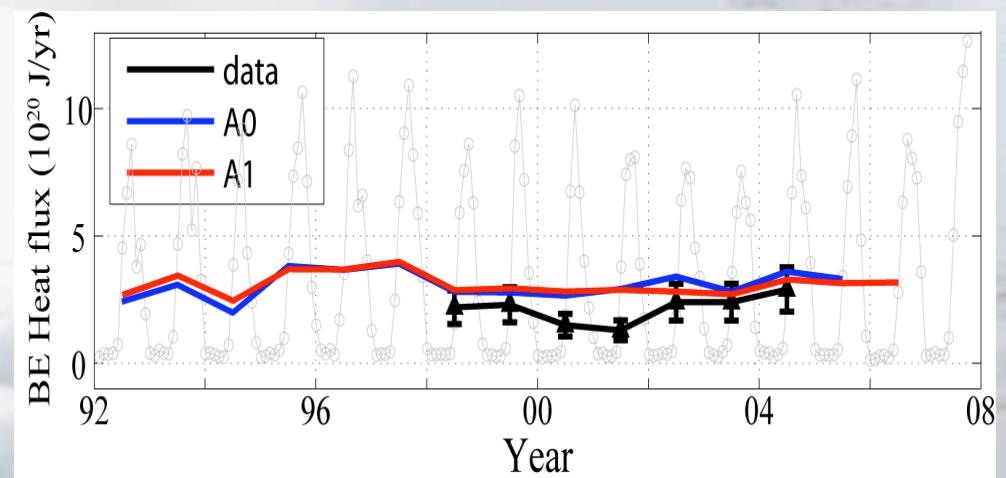
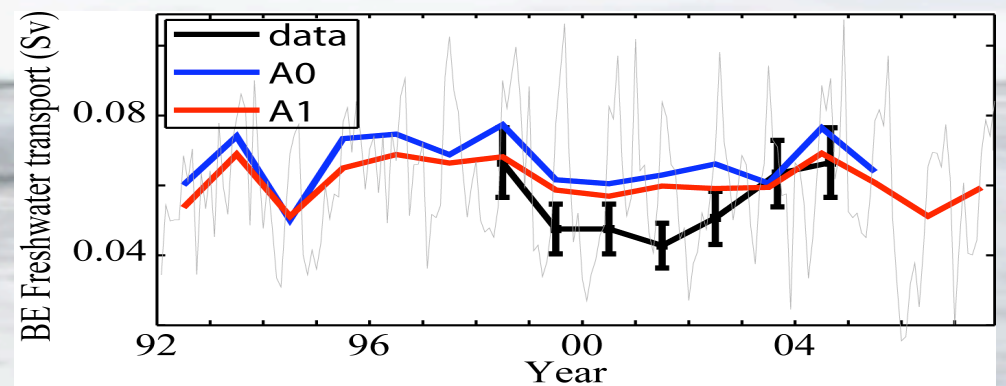
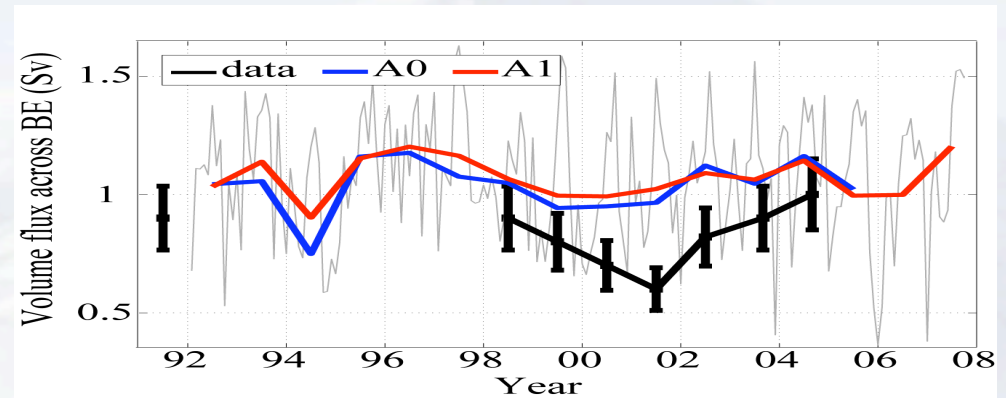
Fresh Water volume (10⁴ km³)



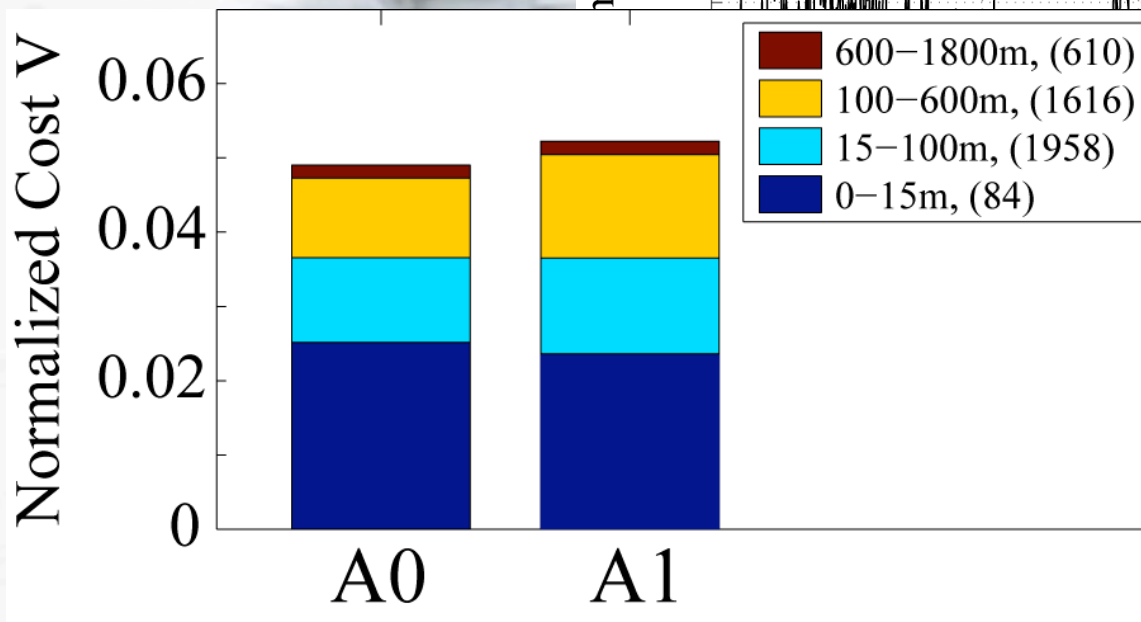
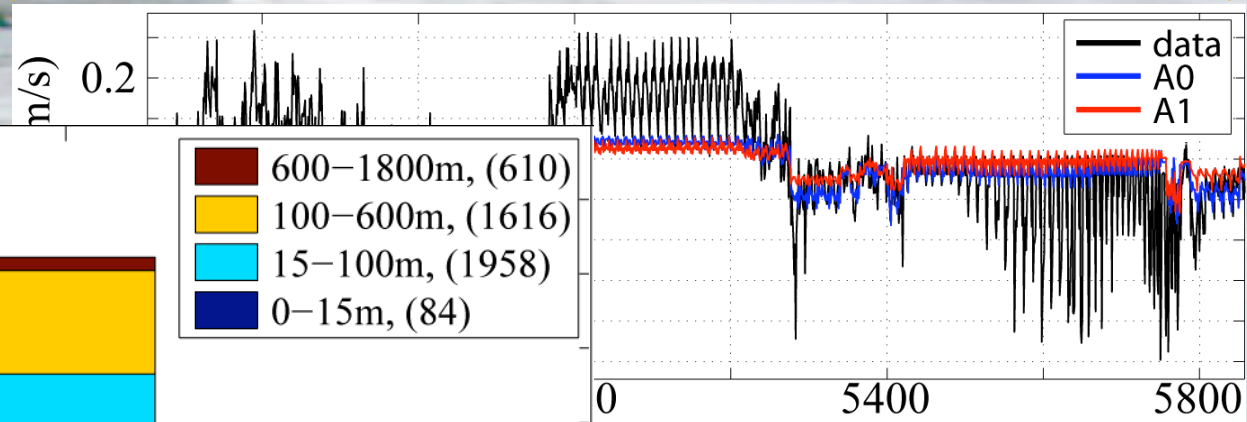
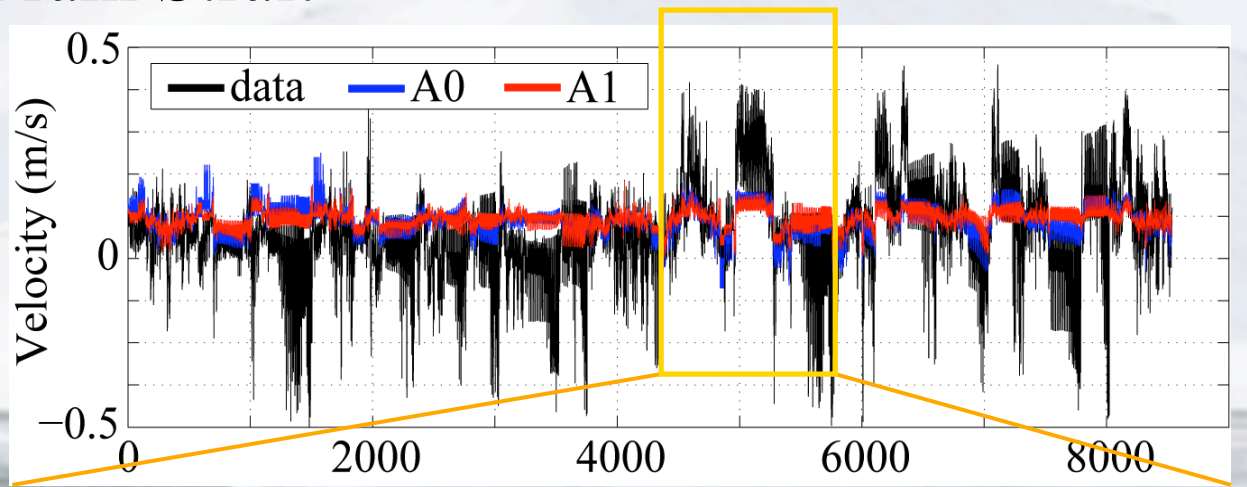
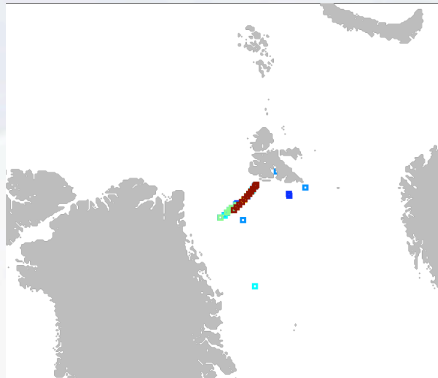
Arctic ocean fluxes: Bering Strait

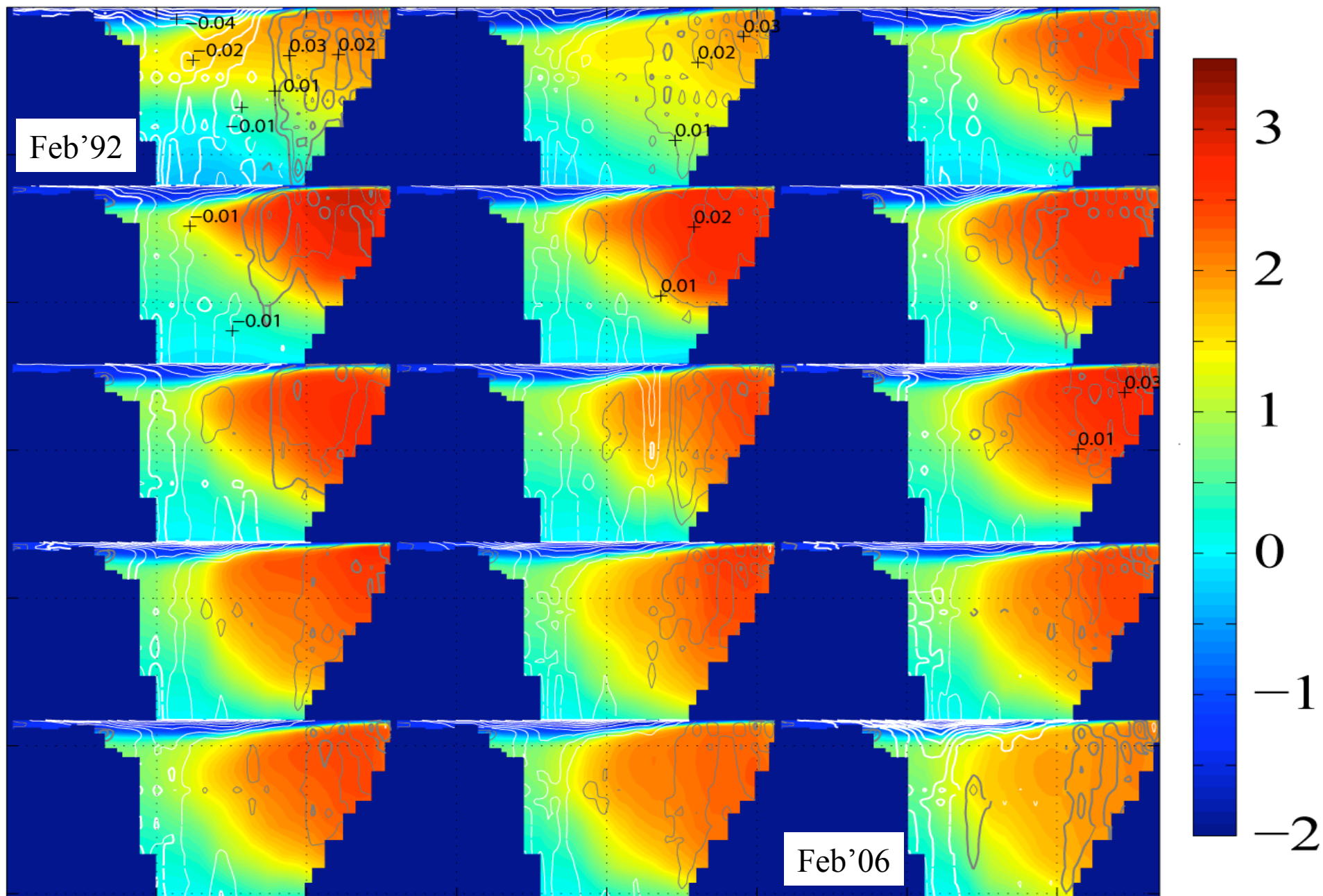


[Woodgate, 2006]

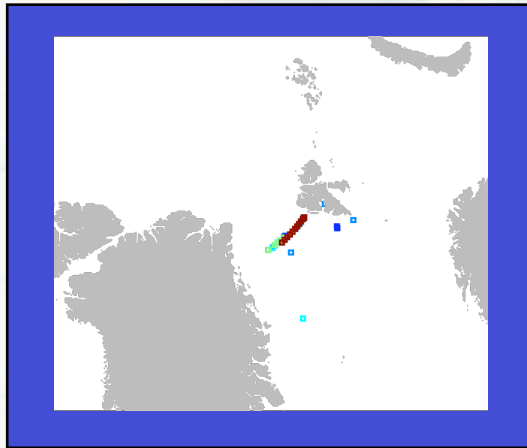


Arctic ocean flux: Fram Strait

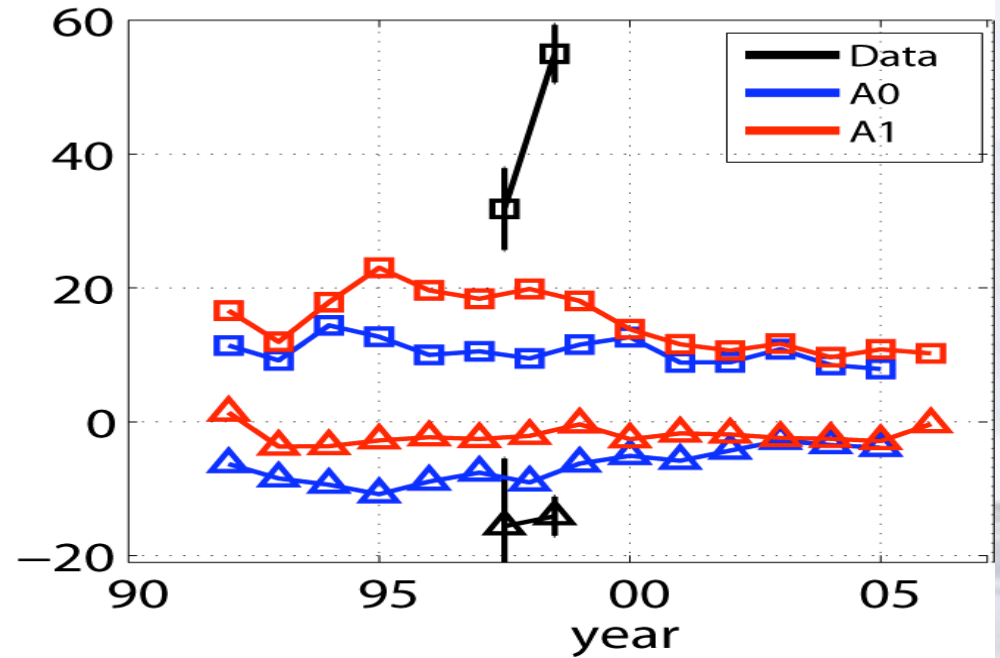




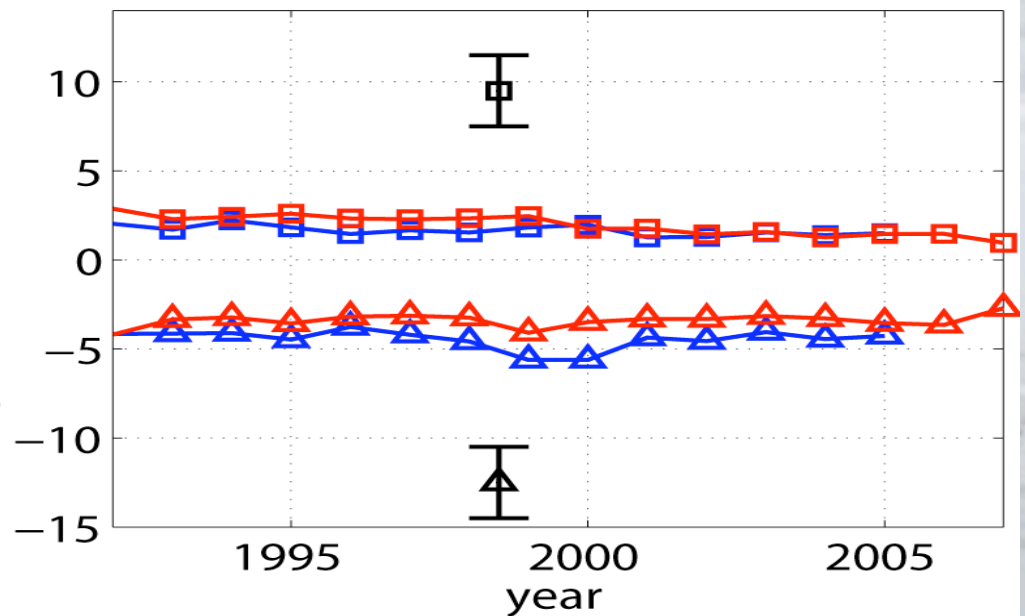
Arctic ocean fluxes: Fram Strait [Schauer, 2004]



Heat transport across Fram Strait (TW)



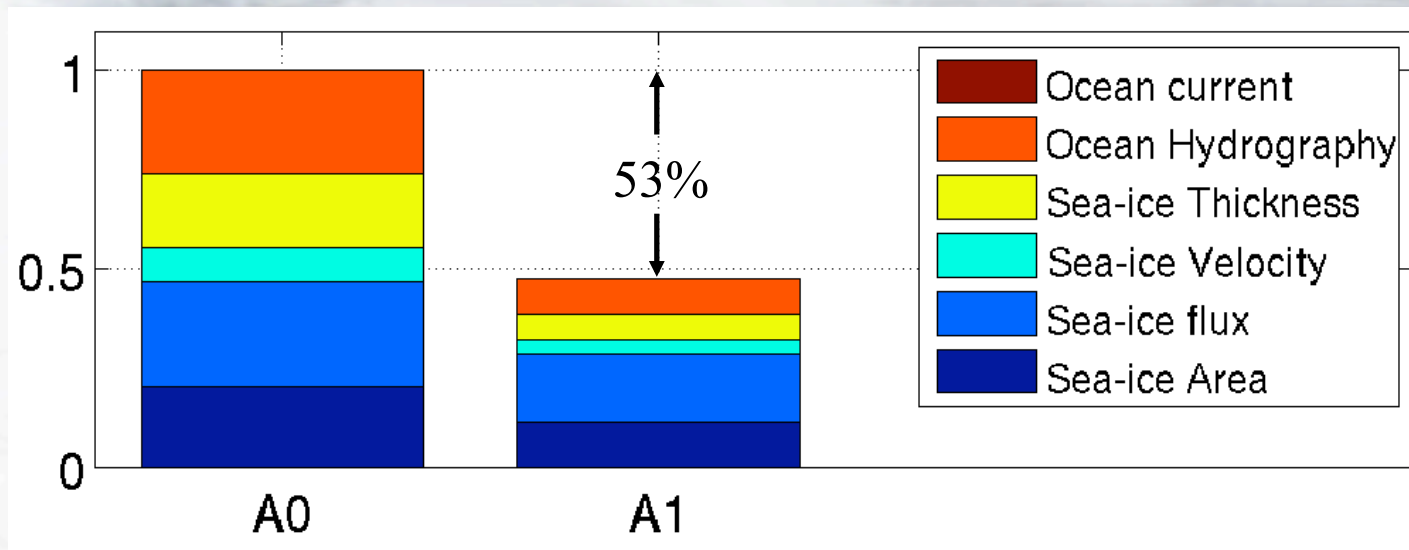
Volume transport across Fram Strait (Sv)



Summary-1:

1) Arctic Ocean:

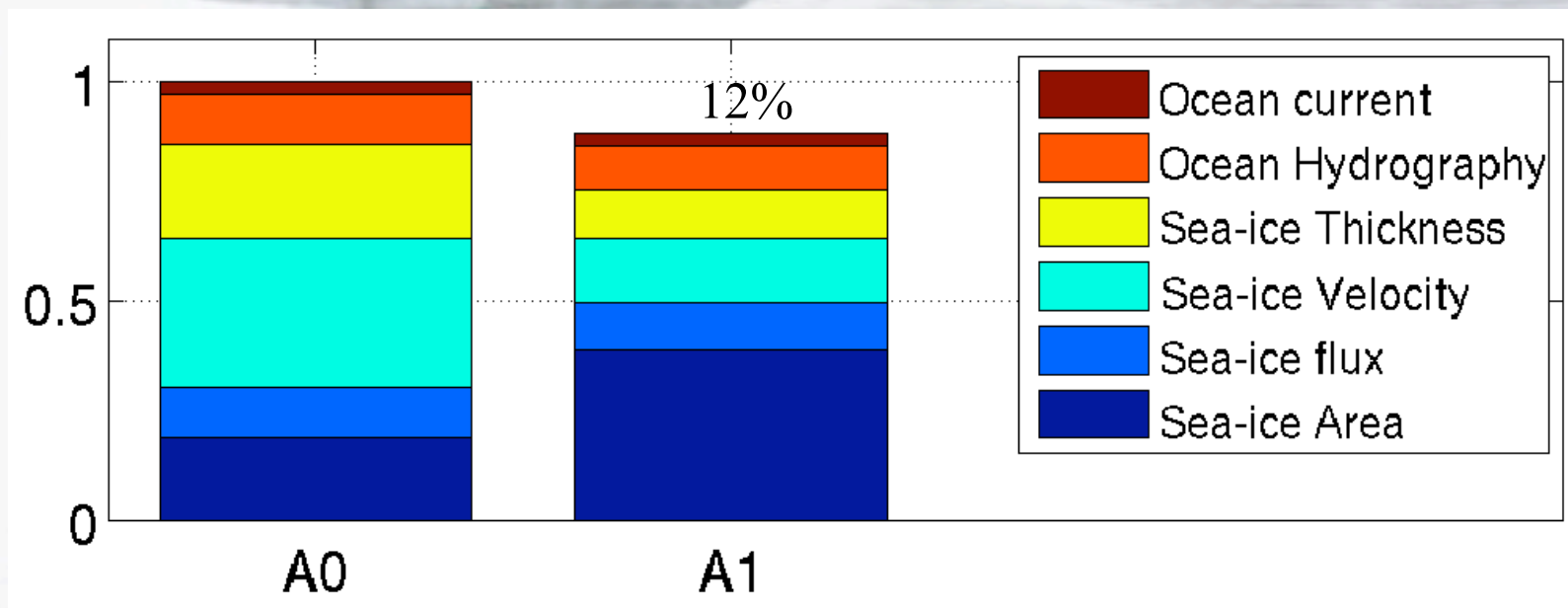
- Summer 2007 sea-ice minimum
- Realistic Halocline
- Freshwater: compatible with Serreze estimates
- Berring Strait: all fluxes compatible with measurements from Woodgate [2006]
- Fram Strait: all fluxes too low compared to Schauer [2006]



Summary-2:

2) Greenland Sea: vertical mixing issues

- hydrography too diffused
- weak currents
- too low heat and volume fluxes into the Arctic



A photograph of a snowy mountain landscape. In the foreground, there is a body of water with several large, white, snow-covered ice floes. The water is a pale blue-grey color. In the background, a large, snow-covered mountain rises, its slopes showing some texture and shadows. The sky is a pale, hazy blue. The word "END" is written in a black, serif font, underlined, in the center of the image.

END

Summary-1: Sea Ice

1. Sea Ice flux:

- over-estimates net ice export across Fram Strait by 40% to 60%

2. Sea ice thickness/extent/volume:

- too much ice extent in winter, too little in summer
- ice thickness small relative to ULS data in Arctic ocean
- closer to data in Greenland sea
- ice volume too small, with **positive** trend!

3. Sea ice velocity:

- parallel to wind direction, consistently to the left of data
- turning angles correlate with magnitude of Δv

List of things to do (04/13/07):

- 1) Fix drifts in Arctic domain
- 2) Fix vertical mixing
→ fix ice thickness + ice vol + fresh water vol?
- 3) Jinlun's comments:
 - Initial condition for ice thickness: in the wrong season?
 - Ice extent problem in summer: thermodynamics
 - Tear-drop vs. elliptical yield curves:
might not solve discrepancies of vel near coast
 - Need to check if stresses lie on the yield curve

Sea ice volume

